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ABSTRACT

The Marine Science Aquaculture Project is a program designed (1) to provide secondary and postsecondary students with job entry-level skills for employment in the shell fisheries industry; (2) to give students instruction and hands-on experience in the fundamental processes of seeding shell beds, monitoring and recording growth, and harvesting and marketing the mature product; (3) to develop and encourage continuous presentation of unpolluted areas for aquaculture purposes; and (4) to assist project graduates in contributing to the future development of the industry. Included among project procedures were the following activities: revision of an existing marine environmental occupations program; identification of area specialists to provide additional information; involvement of project instructors and students in collecting, growing, and harvesting shell fish; field trips to polluted and unpolluted shell fish areas; trips to other marine and aquaculture programs; career counseling and job placement of project students; and introduction of project students to the services of public and private organizations related to the industry. Data from a project-developed performance test and a vocational student profile for shell fishing occupations attested to the project's effectiveness. In addition, 50 percent of the project's first-year participants found employment in the field or related fields. (MN)

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ED 206886

CAPE MAY COUNTY VOCATIONAL SCHOOLS

CREST HAVEN ROAD, CAPE MAY COURT HOUSE, NJ 08210

PREPARATION OF SECONDARY AND
POST-SECONDARY STUDENTS FOR ENTRY-LEVEL
EMPLOYMENT IN THE SHELL FISHING INDUSTRY

SEMG - 168

FINAL REPORT

Project Director
Hans Toft

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION

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**FINAL REPORT
OF
PREPARATION OF SECONDARY AND
POST-SECONDARY STUDENTS FOR ENTRY-LEVEL
EMPLOYMENT IN THE SHELL FISHING INDUSTRY**

1980 - 1981

**Cape May County Vocational Schools
Crest Haven Road
Cape May Court House, New Jersey**

**Project Director
Hans Toft
Department Head**

This project reported herein was conducted pursuant to a contract from the New Jersey Department of Education, Division of Vocational Education and Career Preparation. It was funded under Section 132 of Public Law 94-482.

Project Duration:

July 1, 1980

Beginning Date

June 30, 1981

Ending Date

The Contractors undertaking this project were encouraged to express fully their judgments in professional and technical matters. Points of view or opinions do not, therefore, necessarily represent official funding agency positions or policies.

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IDENTIFICATION NO. SEMG - 168

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PROJECT TITLE: Preparation of Secondary and Post-Secondary Students for Entry-Level Employment in the Shell Fisheries Industry

LEGAL NAME OF APPLICANT
DISTRICT, INSTITUTION OR
AGENCY:

Cape May County Vocational School District

ADDRESS:

Crest Haven Road

Cape May Court House, New Jersey 08210

PROJECT DIRECTOR:

Hans Toft, Department Head

TELEPHONE NUMBER:

(609) 465-2161
(Area Code)

ABSTRACT

DESCRIPTION OF PROJECT

(Use this sheet and no more than one other to type in single-spaced form a statement of project objectives, procedures that were followed, state and local priorities emphasized and the expected contribution of the project to vocational education.)

The objectives of this program are: (1) to develop in students job-entry level skills for employment in the shell fisheries industry; (2) to provide students with instruction and hands-on experiences in the fundamental processes of seeding shell fish beds, monitoring and recording growth, and harvesting and marketing the mature product; (3) to develop and encourage continuous presentation of unpolluted areas for aquaculture purposes; and (4) to assist project graduates in contributing to the future development of the industry.

Procedures include the revision of an existing Marine Environmental Occupations program to incorporate increased emphasis on the above objectives; identification of area specialists to provide additional information; involvement of project instructor and students in collecting, growing, and harvesting shell fish; field trips to polluted and unpolluted shell fish areas for observation; trips to other marine and aquaculture programs for supplementary information; utilization of print and non-print media to obtain a perspective on the shell fisheries industry and the careers related to it; counseling and job placement of project students; and the introduction of these students to the services of public and private organizations with a relationship to the industry.

Federal, state and local governments have emphasized the need for developing the potentialities of estuarial areas. The Federal Department of Agriculture has been designated as the agency responsible for encouraging aquaculture, especially shell fishing. New Jersey passed the "Wetlands Act" in 1970,

protecting areas vital to the shell fisheries industry from encroachment by development. A state task force on aquaculture is currently emphasizing the need to move ahead in this area. The Cape May County Planning Board has also established in its "Land Use Plan" the necessity for maintaining these essential areas. The priorities of this grant are geared to meeting the needs identified both locally and on higher governmental levels for the continuation of a unique primary industry and the ecological preservation of the areas essential to the success of that industry.

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A. INTRODUCTION

1. Need and Problem

There is a need in coastal counties to use environmental resources to the fullest, to encourage preservation of unpolluted aquatic areas, and to provide graduates of environmentally-related vocational programs with opportunities to broaden their occupational aspirations. In Cape May County, secondary and post-secondary graduates of the Marine Environmental Occupations program are placed in a variety of jobs. This project has provided them with hands-on training in an occupational area which a telephone survey of appropriate education agencies indicated no formal training was available. Workers who grow and harvest oysters, clams, and crabs in the back bays usually operate independently. Students in this program have been able to practice aquaculture by seeding shell fish beds, recording growth, and harvesting and retailing the final products. This involvement has provided vocational experiences to help students choose satisfying careers. It has also provided "career awareness and vocational education" and "job entry level skills" training as mandated by the T & E process.

2. Objectives

The major objectives of the Preparation of Secondary and Post-Secondary Students for Entry-Level Employment in the Shell Fishing Industry have been:

- a. To develop in students the job-entry level skills for employment in the shell fisheries industry.
- b. To provide students with instruction and hands-on experiences in the fundamental processes of seeding shell fish beds, monitoring and recording shell fish growth, and harvesting and retailing mature shell fish.

- c. To develop and encourage continuous preservation of unpolluted areas for aquaculture purposes.
- d. To assist project graduates employed in Cape May County in contributing to the future economic development of a unique and fundamental industry.

3. Related Research

On September 19, 1979, Governor Byrne signed into law the "Marine Fisheries Management and Commercial Fisheries Act" which set up the Task Forces on Aquaculture and Commercial Fisheries Development to see that the fisheries industries of this state are developed to their fullest potential.

The language of the new law clearly states that the Task Forces are to "define the roles of the various State agencies in carrying out a permanent program to promote the development of an aquaculture program and of a commercial fisheries industry." The intention of this proposal has been to carry out the early stages of preparing workers for the marine fisheries industry that is hoped to be developed from the expansion of the marine fisheries industry as proposed by the governor.

The following citations are representatives of an ERIC search of approximately forty-eight studies in the ERIC system completed within the last three years and other documents from the Aquaculture Task Force. Goodwin, in 1978, described the various careers available to today's youth in tomorrow's sea including diving and off-shore industries.

Speeches presented at the Marine Occupation conference in South Portland, Maine provide an overview of availability and kinds of careers in marine occupations. They also review problems of different harvesting techniques and various gear requirements. This project emphasizes the opportunities for youth in the shell fishing industry. It concentrates on developing job entry level

skills in this field.

The Aquaculture Task Force in its January 17, 1980, meeting expressed its intent to work toward the encouragement of the development of the fisheries industry in New Jersey and the methods of production.

The Federal Government in April, 1978 expressed concern because the United States imports more than half its fish foods per year. As a result, the Department of Agriculture has been designated as the agency responsible for encouraging aquaculture in general and shell fishing in particular. This project addresses the acquisition of knowledge of the fundamental processes of shell fishing growth, development and harvesting along the shoreline of New Jersey.

In the May/June, 1975 issue of Mosaic, the necessity for aquaculture linked to conservation is explored. The key role of aquaculture in supplying large amounts of food at no cost in nonrenewable energy resources is examined.

The "Wetlands Act" of 1970 (N.J.S.A. 13:9 A-1, et. seq.) and the "Land Use Plan" of the County Planning Board advocate the maintenance of large amounts of meadowland and wetlands as permanent open space areas essential to the preservation of the fisheries industries and important ground water recharge areas. This project addresses the development and encouragement of conservation of the environment for aquaculture purposes.

In June, 1977, Goodwin also investigated the various career possibilities related to the sea. He examined job responsibilities, duties, skills needed and location opportunities in the fisheries industry.

The New Jersey Task Force on aquaculture also indicated its desire to create a program designed to capitalize upon New Jersey seafood industry at state and national levels. This proposal assists in providing graduates capable of making contributions to this unique primary industry for New Jersey.

B. BODY OF REPORT

1. Procedures Used

The Marine Science Aquaculture Project has as its primary goal the development of job-entry skills in the shell fisheries industry. The first two objectives of the project "To develop in students the job-entry level skills for employment in the shell fisheries industry" and "To provide students with instruction and hands on experiences in the fundamental processes of seeding shell fish beds, monitoring and recording shell fish growth and retailing mature shell fish" are subsumed under that general goal.

In order to meet the first objective, a committee of teachers, administrators and citizen advisory council members were selected to review the existing course of study in Marine Environmental Occupations and to make recommendations to expand or modify it to meet the proposed project objectives. The existing course of study was revised and updated in March, 1980 and its organization and content are summarized on the vocational student profile (Table 1) Marine Environmental Occupations.

The Advisory Council was comprised of the county Marine Extension Service agent, a marine biologist for the state of New Jersey, a commercial bay clammer, a commercial surf clammer, a marine biologist for the Division of Fish, Game and Wildlife and a former student (female) employed in the environmental field. The modifications of the existing course of study are summarized.

MARINE ENVIRONMENTAL OCCUPATIONS

LEARNING EXPERIENCE/ACHIEVEMENT

Please evaluate this student by placing an "X" in the proper column

EXCELLENT
GOOD
AVERAGE
FAIR
POOR
DOES NOT
APPLY

General Ecology

Species List

Food Chain & Web

Marine Biology Terms

Marsh Birds/Ducks I.D.

Group of Phylums

Fish Classification

Fish Dissection/I.D.

External

Internal

Oceanography Equipment

Hydrometer

Salinometer

Oxygen Kit

Thermometer

Ocean Geology

LEARNING EXPERIENCE/ACHIEVEMENT

Please evaluate this student by placing an "X" in the proper column

EXCELLENT
GOOD
AVERAGE
FAIR
POOR
DOES NOT
APPLY

Chart of Coastal Beaches

Properties of Sea Water

Physical

Chemical

Waves/Tides Currents

Navigation Skills

Buoys, Beacons, Ranges

Scuba Skills

Diving Techniques

Dendrology

Forestry

Chain Saw/Axe

Wildlife Management

Wildlife -
Dissecting, Identifying

Tagging & Trapping

Fish Market Operations

Job Orientation

LEARNING EXPERIENCE/ACHIEVEMENT

Please evaluate this student by placing an "X" in the proper column

EXCELLENT
GOOD
AVERAGE
FAIR
POOR
DOES NOT
APPLY

Customer Relations -
Marketing

Career Orientation

INSTRUCTORS COMMENTS:

in the vocational student profile (Table 2- Shell fishing Occupations).

The advisory council was an integral part of the process of devising the performance test administered to help evaluate effectiveness of the program. The individual items on the performance test were developed using the following procedures:

1. Basic job-entry level skills for shell fisheries industry were identified by project director and instructors.
2. Basic skills were then presented to advisory council for verification.
3. After basic skills were identified, the following data were gathered about each skill from instructors and advisory council:
 - a. Is the task critical, essential or not essential to entry level performance.
 - b. How frequently is the task performed on the job? Always, often, or seldom?
4. Outside evaluation of these skills was sought from individuals in state, regional or national organizations associated with the shell fisheries industry.

The results of both the performance test and the survey conducted to construct the performance test will be reported in the section of this report entitled "Findings."

The second set of procedures conducted to meet the objective of development of job-entry skills in the shell fisheries industry was the utilization of laboratory facilities, related instructional techniques and field experiences to teach the skills identified in the process described above.

In order to meet the second objective, the following procedures were conducted:

1. Working in small groups under the supervision of the project instructor, students participated in a series of activities to fulfill the requirements of the program. These activities included but were not limited to the following:

SHELLFISHING OCCUPATIONS
LEARNING EXPERIENCE/ACHIEVEMENT

LEARNING EXPERIENCE/ACHIEVEMENT

TABLE 2
LEARNING EXPERIENCE/ACHIEVEMENT

Please evaluate this student by placing an "X" in the proper column.	EXCELLENT	GOOD	AVERAGE	FAIR	POOR	DOES NOT APPLY	Please evaluate this student by placing an "X" in the proper column	EXCELLENT	GOOD	AVERAGE	FAIR	POOR	DOES NOT APPLY	Please evaluate this student by placing an "X" in the proper column	EXCELLENT	GOOD	AVERAGE	FAIR	POOR	DOES NOT APPLY
Knowledge of Life Cycles: Oyster Life Cycle							Spat Collection							Checked out on Scuba Equipment						
Scallop Life Cycle							Seed Clams Collection							Collection of Shellfish						
Mussel Life Cycle							Soft Shell Clam Collecting							Basic Snorkling						
Crab Life Cycle							Locating Habitat							Skin Diving/Shellfish Collecting						
Eel Life Cycle							Reading Tide Tables							Knot Work						
Shellfish Terminology							Making Crab Pots							Pollution Factors						
Equipment Identification							Baiting Crab Pots							Oyster Tray Construction						
Predators Species I.D.							Setting Crab Pots							Media Utilization						
Shellfish Cultivation							Harvesting Crabs							Fish Market Operations						
Sorting Shellfish - Market Size							Equipment Proper Use/Safety							Cash Register Operations						
Use of Rake or Tongs							Small Boat Handling							Handling Money/Counting Change						
Growth Data Collecting							Outboard Motor Use							Customer Relations/Marketing						
Proper Data Reading							Winterization of Boat							Shellfish/Fish Preparation						
Use of Waders							Boat Launching							Career Orientation						
Proper Shellfish Handling							Rules of the Road													
Spat Sowing & Setting							Boating Terminology													
							Use of Wet Suits for Treading Clams													

- a. Constructing oyster trays and crab pots and researching appropriate areas for their placement.
 - b. Collecting oyster spat (immature oysters) and seed clams in the Delaware Bay during the regular school day.
 - c. Relocating the immature shell fish in student-constructed aquafarm areas on school property in the section of the inland waterway known as Great Sound.
 - d. Maintaining records in the following areas: rate of growth, water and air temperature, loss due to parasites, time elapsed from placement to marketable size.
 - e. Harvesting shell fish, using small boats, clam rakes, oyster tongs, and crab pots.
2. Additional activities covering marketing and distribution of shell fish were performed.

The activities for the second objective as evaluated by teacher observation, teacher-made tests, progress charts, and self-assessment evaluations are summarized on the vocational student profile for Shellfishing Occupations (Table 2). The results for both graduates and returning students will be reported in the section of this report entitled "Findings."

The third objective of the project has been "To develop and encourage continuous preservation of unpolluted areas for aquaculture purposes." To foster this objective the following procedures were used:

1. Field trips were taken by students to polluted and unpolluted (protected or preserved) shell fish areas for comparative studies or observations.
2. Identified experts and specialists in the shell fish industry made presentations to the students to inculcate the traditions of the shell fish industry.
3. Students have reviewed, studied and utilized current print and non-print media addressing the development, expansion and protection of the shell fish industries. A copy of the bibliography developed and used is found in the appendix.
4. Students utilized proper record-keeping techniques essential for monitoring a quality shell fish production operation. (A sample record is found in Table 3 A & B)

The results of activities for this objective are reported in the section of the report entitled "Findings."

The fourth objective of the project has been "To assist project graduates employed in Cape May County in contributing to the future economic development of a unique and fundamental industry." To meet this objective, the following procedures were conducted:

1. School guidance and counseling staff assisted potential graduates in identifying job opportunities and requirements in shell fish industries.
2. Detailed career information was provided through the district's career resource center.
3. Project participants became acquainted with the services of the Chamber of Commerce, County Planning Board, County Agricultural Station, County Health Department, Private Industrial Council, and environmental advocacy groups.

The results of these activities are reported in the section of the report entitled "Findings."

TABLE 3-A
OYSTER GROWTH MONITORING FORM RECORD

OLYSTER #						Cage #4	Substratum #9
	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	
1		30mm			31mm	33mm	
2		27	I	I	27	28	
3		24	C	C	26	26	
4		31	E	E	31	dead	
5		31			33	33	
6		9			11	14	
7		10			12	dead	
8		14			14	16	
9		13			dead		
10		14			dead		
11		9			11	12	
12		13			13	15	
13		13			16	17	
14		6			dead		
15		13			dead		
16		13			dead		
17		10			10	12	
18		10			11	13	
19		13			16	dead	
20		10			dead		
21		10			10	11	
22		8			10	12	

TABLE 3-B
OYSTER GROWTH MONITORING FORM - VISUAL

Cage # 4 Substratum # 9

(On Clamshell)



Front

Hinge



Back

2. Findings

The preparation and implementation of the performance test was one of the accomplishments of the grant. The survey (Table 4) was completed by members of the citizen advisory council, instructors, individuals in the New Jersey Bureau of Shell Fisheries and the National Shell Fisheries Association. Using the Dictionary of Occupational Titles skills were listed for the following job titles:

Shell fish Grower -	14 skills
Shell fish-Bed Worker-	12 skills
Soft Crab Shedder -	7 skills
Fisher: Diving-	5 skills
Fisher: Line -	8 skills
Shell fish Farmer -	4 skills
Fish Cleaner	7 skills

The skills formed the base from which to choose the items for the performance test. It was discovered that 13 of the 57 skills (22.8%) received a response of 50% or higher in the non-essential column. Also, 17 of the 57 skills (29.8%) had a response of 50% or higher in the seldom column. The survey found 12 of the 57 skills (21.0) received a response of 50% or higher in both the seldom and the non-essential columns. These twelve skills were eliminated from consideration on the performance test. Those twelve skills were Shell fish Grower #3, 4, 5, 12, and 13; Shell fish-Bed Worker #4, 6, and 8; Soft Crab Shedder #7; Fisher: line #8; and Fish Cleaner #5 and 7.

Next a matrix was devised which consisted of the nine possible combinations of responses for each of the 57 skills. (The twelve skills eliminated from consideration on the performance test were included on the matrix.) The category of "No Answer" was, of necessity, added to the matrix. The responses were recorded in the following distribution:

TABLE 4

page 1

	Importance to job Check one			How frequently used Check one		
	Critical	Essential	Not Essential	Always	Often	Seldom
The following are skills identified for the occupation of fisher, diving: - Gathers or harvest marine life, such as sponges, abalone, pearl oyster, and geoducks from sea bottom, wearing wet suit and scuba gear, or diving suit with air line extending to surface. - Climbs overboard or is lowered into water from boat by lifeline. - Picks up oysters. - Places catch in bag or basket and tugs on line to have catch pulled to boat, or surfaces and empties catch on boat or in container. - Signals other workers to extend or retract air lines.						
The following are skills identified for the occupation of fisher, line: - Catches fish and other marine life with hooks and lines. - Lays out line and attaches hooks, bait, sinkers, and various anchors, floats, and swivels, depending on quarry sought. - Puts line in water. - Stows catch in hold or boxes and packs catch in ice. - Hits fish with club to stun it before removing it from hook. - Slits fish, removes viscera, and wash cavity to clean fish for storage. - Steers vessel in fishing area. - When fishing with line held in hand is designated as Fisher, Hand Line.						

page 2

1. Cultivates and harvest beds of shellfish such as clams and oysters.
2. Lays out and stakes tide flats.
3. Piles up stone, poles, and mud.
4. Makes dikes to control water drainage at low tide.
5. Removes debris by hand and levels soil with tractor and harrow.
6. Sows spat by hand or with shovel or sets out strings or baskets of shells onto which spat attaches.
7. Covers seeded area with mixture of sand and broken shells or transfers seeded strings or baskets to growing area.
8. Rigs net or star mop and drags it over bed behind power boat to entangle and remove shellfish predators, such as crabs and starfish,
9. Walks about bed at low tide, and scoops or digs shellfish and piles them onto barge or mud sled, using pitchfork or shovel.
10. Packs shellfish, according to market specifications in containers and returns small ones to bed.
11. Poles barge to wharf at high tide or pulls it, using boat.
12. Drags mud sled from bed, using tractor.
13. May pour oil around bed and spread oil-treated sand over bed with shovel to form chemical barrier to shellfish predators.
14. May reach from boat with rake-tongs and grope for shellfish by moving handles to open and close tongs

Importance to job Check one			How frequently used Check one		
Critical	Essential	Not Essential	Always	Often	Seldom

27

TABLE 4

The following are skills identified for the occupation of shellfish farmer:

1. Confers with manager to determine time and place of seed planting, cultivating, feeding, and harvesting shellfish.
2. Plans work schedules according to tidal levels.
3. Inspects beds and ponds to ascertain the quality of seed distribution, adequacy of cultivation, and completeness of harvesting.
4. Oversees maintenance of planting, cultivating, and harvesting equipment, tidal pens, and shellfish beds.

The following are skills identified for the occupation of shellfish-bed worker:

1. Loads marking stakes on barge, and moves barge to shellfish bed.
2. Drives stakes into mud using sledge hammer.
3. Sows spat by scattering it within staked enclosure.
4. Covers seeded area with mixture of sand and broken shells of shellfish onto which spat attaches, using a shovel.
5. Wades in shellfish bed and digs or rakes for shellfish using rake, fork, and spade.
6. Treads in water and feels for shellfish with bare feet.
7. Reaches from boat with rake-tongs and gropes for shellfish by moving handles to open and close tongs.
8. Drags brail rod behind powerboat to pull shellfish from mud.
9. Rigs and lowers dredge into shellfish bed from mast and boom of powerboat, using block and tackle.
10. Hoists dredge and pulls dump ring to empty catch.
11. Picks out market size shellfish from catch, and replants smaller ones.
12. Unloads loose shellfish from boat, using shovel.

Importance to job
Check one

Critical

Essential

Not
Essential

How frequently used
Check one

Always

Often

Seldom

TABLE 4

page 4

	Importance to job Check one			How frequently used Check one		
	Critical	Essential	Not Essential	Always	Often	Seldom
The following are skills identified for the occupation of fish cleaner: 1. Scrapes scales from fish with knife. 2. Cuts or rips fish from vent to throat with knife, and tears out viscera and gills. 3. Cuts off head of fish with knife, drops head in tub. 4. Washes blood from abdominal cavity by dropping fish in tub of water and removes discolored membrane from abdomen lining with knife, spoon, scraper, glove, or piece of burlap. 5. Cuts gashes along sides of fish. 6. Cuts fish behind gill slits and draws knife along backbone and ribs to free fillet, lays fillet skinside down on table and draws knife laterally between skin and flesh to remove skin. 7. Slices flesh from bones in fletches.						
The following are skills identified for the occupation of soft crab shedder: 1. Catching crabs from sea and retaining them in tanks until they molt. 2. Catches crabs using lines. 3. Sorts crabs according to stages of shell development. 4. Puts them into open tanks containing sea water. 5. Starts pumps to aerate water and maintain constant flow of sea water through tanks. 6. Observes crabs to ascertain when they begin to shed their brittle outer shell. 7. Holds shell being shed when necessary, to assist emerging crab that gets hung in shell during molting.						

Essential - often - 25.1%
 Critical - always - 24.5%
 Non-essential - Seldom - 23.7%
 Critical - often 9.3%
 Essential - Seldom - 7.8%
 No answer - 3.5%
 Non-Essential - often - 2.6%
 Critical - seldom - 2.0%
 Essential - always - .8%
 Non-essential - always - .3%

One purpose of the matrix was to determine if any skills that were critical or essential were seldom performed. The results showed 9.8% of the responses in these two categories.

Using the information thus gathered, the survey instrument was coded on an item by item basis. Green was used for items in the 60% or more critical or essential category. Red was used for items with 60% or more non-essential. Yellow was used for items falling between these two extremes. The performance test has items either demonstration or paper and pencil corresponding to all the green coded items, many of the yellow coded items and none of the red coded items.

The performance test (Table 5) was administered during the last 30 days of the project. The test consisted of 32 performance items, 10 true-false items, 10 multiple-choice items and 10 matching items.

The performance/demonstration items were performed over a two week period. Seven of the items (21.) Shedder tank construction, (22.) Shedder preparation, (24.) Reading crab signs, (27.) Use of CB radio, (28.) making trot line, (29.) Using trot line and (31.) Light salvage, were not tested. This was due to the lack of opportunity to include the teaching of all these skills during the first year of the project. They were, however, included for the purpose of comparison. Returning students will be pre and post-tested in the second year of the project.

The highest possible score when adjusted for the omission of the seven items was 62.5. Student performance ranged from a high of 59.75 to a low of 22.50. The median score was 44.50 and the mean was 45.52.

Student performance on each item of the demonstration test was computed by determining an average for each item. The highest possible average was a 2.50 and the lowest was 0.00. Student performance was best in the following areas:

- 3. Use of wadders - 2.30
- 1. Clam rake use - 2.20
- 15. Knot work - 2.18
- 26. Net making - 2.15
- 20. Shell fish preparation - 2.11
- 23. Sorting crabs - 2.10
- 8. Use of crab pots - 2.10

In addition to seven areas in which performance was not measured, there were three areas in which so few students were tested that the average score was 1.50 or below. The score was due to lack of performance rather than poor performance. These areas were:

- 9. Use of eel pots - .16
- 17. Basic scuba - .45
- 32. Underwater work - .45

The item analysis will give areas upon which to concentrate for the second year of the project.

The written (paper and pencil) portion of the performance test was administered during a one hour class period. This portion of the performance test consisted of 10 true-false items with a value of .5 per item, 10 multiple choice items with a value of 1.0 per item and 10 matching items with a value of .5 per item. The highest possible score was 20. Student performance range from a high of 20 to a low of 7. The median score was 14.5 and the mean was 13.65.

TABLE 5

AQUACULTURE PROJECT PERFORMANCE TEST

Name of Student _____

Date _____

PART I - PERFORMANCE

Directions: You will be asked to perform the following tasks. There will be some tasks you can perform well and others you may not be able to perform at all. Do each task carefully and to the best of your ability. Your instructors will rate you using the following scale:

E = Excellent	2.50 points
G = Good	2.25 "
A = Average	2.00 "
F = Fair	1.75 "
P = Poor	1.50 "
N = Not performed	0.00 "

1. Clam rake use	E	G	A	F	P	N
2. Spat collection	E	G	A	F	P	N
3. Use of waders	E	G	A	F	P	N
4. Locating habitat	E	G	A	F	P	N
5. Reading tides	E	G	A	F	P	N
6. Making crab pots	E	G	A	F	P	N
7. Making eel pots	E	G	A	F	P	N
8. Use of crab pots	E	G	A	F	P	N
9. Use of eel pots	E	G	A	F	P	N
10. Boat launching	E	G	A	F	P	N
11. Rules of road	E	G	A	F	P	N
12. Use of wet suits	E	G	A	F	P	N

13. Treading clams	E	G	A	F	P	N
14. Basic snorkeling	E	G	A	F	P	N
15. Knot work	E	G	A	F	P	N
16. Cash register	E	G	A	F	P	N
17. Basic scuba	E	G	A	F	P	N
18. Boat docking	E	G	A	F	P	N
19. Fish preparation	E	G	A	F	P	N
20. Shellfish preparation	E	G	A	F	P	N
21. Shedder tank const.	E	G	A	F	P	N
22. Shedder preparation	E	G	A	F	P	N
23. Sorting crabs	E	G	A	F	P	N
24. Reading crab signs	E	G	A	F	P	N
25. Use of gill net	E	G	A	F	P	N
26. Net making	E	G	A	F	P	N
27. Use of CB radio	E	G	A	F	P	N
28. Making trot line	E	G	A	F	P	N
29. Using trot line	E	G	A	F	P	N
30. Fish market	E	G	A	F	P	N
31. Light salvage	E	G	A	F	P	N
32. Underwater work	E	35	A	F	P	N

PART II - WRITTEN

TRUE & FALSE - Each correct answer receives .5 points

Indicate with a "+" or "0" whether each of the following statements is true or false

- _____ 1. A fish must be scraped with a head to tail motion to remove scales.
- _____ 2. To find "red sign" on a peeler crab, examine the tips of the claws.
- _____ 3. Soft crabs are always removed from "holding cars" immediately after shedding.
- _____ 4. A thin, narrow bladed knife is best for use in filleting a fish.
- _____ 5. "White sign" is the final indication that a blue crab is about to molt.
- _____ 6. Areas marked "condemned to harvesting of shellfish" are open only to licensed shellfishers.
- _____ 7. A bowline is a knot used only on the bow of a vessel.
- _____ 8. A fiberglass Professional Fishing Device meets U.S. Coast Guard requirements for "P.F.D.'s."
- _____ 9. Female horseshoe crabs are used as eel bait because eels like horseshoe crab eggs.
- _____ 10. Scuba divers must breath pure oxygen when diving deeper than 33 feet.

MULTIPLE CHOICE - Each correct answer receives 1.0 points

Complete the following statements with the best answer

- _____ 1. Tides are caused by which of the following:
- A. Gravitational pull of the sun and the moon
 - B. Wind direction
 - C. Distance of the earth to the moon
 - D. All of the above
- _____ 2. Two vessels approaching each other head on should:
- A. Give one short blast and pass port to port
 - B. Give two short blasts and pass starboard to starboard
 - C. "Heave to" and batten down the hatches
 - D. A or B
 - E. None of the above
- _____ 3. A zinc bar is attached to steel wire crab pots to:
- A. Prevent marine growth from fouling the pot
 - B. Protect the pot from corrosion
 - C. Hide the scent of man
 - D. All of the above
- _____ 4. The correct order of peeler crab sign is:
- A. Red sign, pink sign, white sign
 - B. Peeler, shedder, molt
 - C. White sign, pink sign, red sign
 - D. Green crab, blue sign, red sign
 - E. None of the above
- _____ 5. The cause of an air embolism is:
- A. Over exertion of the heart
 - B. Holding breath while ascending on scuba
 - C. Excess hyperventilation
 - D. Excess nitrogen in the body tissue
 - E. All of the above
- _____ 6. Goggles are not recommended for use in diving because:
- A. The nose is exposed to water
 - B. You cannot equalize with them
 - C. They tend to leak
 - D. They restrict vision
 - E. None of the above

_____ 7. Decompression sickness or the "bends" is caused by:

- A. Supersaturation of nitrogen in body tissue
- B. Monoxide combining with hemoglobin thus creating nitrogen excess
- C. Long rupture and air forced in bloodstream
- D. Excessive deep breathing prior to diving
- E. All of the above

_____ 8. The three most dangerous situations that two approaching vessels may encounter are:

- A. Sinking, burning, drifting
- B. Towing, floundering, aground
- C. Passing, head on, crossing
- D. None of the above

_____ 9. A vessel's "danger area" is located:

- A. From dead ahead to 12 points aft the starboard beam
- B. From dead ahead to 10 points port and starboard
- C. Just below the gunwales
- D. From dead ahead to 10 points aft the starboard beam
- E. All of the above

_____ 10. The harvesting of shell fish requires:

- A. A long rake
- B. A license
- C. A good boat
- D. Warm water
- E. None of the above

MATCHING: Each correct answer receives .5 points

Match the description in Column A with the proper term from Column B. Each term may be used only once and there will be two terms which are not used.

- | | | |
|-------|--------------------------------------|---------------|
| _____ | A. Mature female blue crabs | 1. Buster |
| _____ | B. Blue crab in first stage of molt | 2. Colony |
| _____ | C. Larval stage of oyster | 3. Fillet |
| _____ | D. Clams, oysters, mussels | 4. Jimmie |
| _____ | E. External covering on fishes | 5. Net |
| _____ | F. Immature female blue crab | 6. Peeler |
| _____ | G. Male blue crab | 7. Scales |
| _____ | H. Boneless cut of fish | 8. She-crab |
| _____ | I. Blue crab just prior to molt | 9. Shell-fish |
| _____ | J. Rake like device for shellfishing | 10. Sook |
| | | 11. Spat |
| | | 12. Tongs |

PART I sub-score _____

PART II sub-score _____

TOTAL SCORE _____

An item analysis was also completed on the written portion of the performance test. For the purpose of computation of this item analysis, each of the 30 items was assigned a value of 1 for correct answers and 0 for incorrect answers. The weights indicated above for the three written sections were not used. Student performance on each item ranged from a high of 1.00 to a low of .37. The median score was .68 and the mean was .70.

The item analysis indicated student performance was best on the following:

- True-False - #1
- True-False - #7
- Multiple-choice #5
- Multiple-choice #10

Student performance was in need of improvement in the following areas:

- Matching #1
- Multiple-choice #2
- True-False #2

This performance test was a major means of evaluating the effectiveness of the first objective "To develop in students the job-entry level skills for employment in the shell fisheries industry."

Another result of the grant was the design of the vocational student profile for shell fishing occupations. While the performance test was an evaluation conducted over a limited period of time, the vocational profile is a summary of activities assessed by various means including teacher observation, teacher-made tests, progress charts, and student self-assessment throughout the entire year. The vocational profile (Table 2) was tallied for two separate groups. The first group consisted of graduates both post-secondary and seniors.

A number of the graduates did well on the items related to the procedures described under objective 2. All items on which 70% or more of the graduating students were evaluated good or excellent were extracted. These items were:

- Shell fish terminology
- Equipment Identification
- Use of waders
- Proper Shell fish handling
- Locating Habitat
- Reading Tide Tables
- Making Crab Pots
- Baiting Crab Pots
- Setting Crab Pots
- Harvesting Crabs
- Equipment Proper Use/Safety
- Collection of Shell fish
- Pollution Factors
- Oyster Tray Construction
- Media Utilization
- Fish Market Operations

The items on the vocational student profile which 60% or more of the graduating students were evaluated average or below were also extracted. These items included:

- Use of Wet Suits for Treading Clams
- Checked out on Scuba Equipment
- Basic Snorkling
- Skin Diving/Shell fish collecting

The second group consisted of returning students both sophomores and juniors. These students were younger and new to the program in the 1980-81 academic year. At the time of this final report, all were scheduled to return for the 1981-82 academic year. Most of the scores for the returning students were in the average to fair range while most of the scores for the graduates were in the good to average range. None of the items for the second group had 70% or more of the students evaluated good or excellent. Only one item, Use of Waders, had 60% or more evaluated average or below. This second group will be evaluated again at the end of the second year of the project. The scores from the first year will be used as a pre-test.

The third objective of the project was "To develop and encourage continuous preservation of unpolluted areas for aquaculture purposes."

Formal field trips to polluted and unpolluted areas were an important aspect of the project. All three project instructors acquired their bus drivers license which facilitated field trips. Trips included the following locales.

Delaware Bay- Pierces Point
Lund's Fisheries
Campbell Wildlife Preserve
Avalon Dune Preservation Area
Cape May Point
Stone Harbor Point
Cedarville- Skin Diving
Green Bank

Informal field trips either by foot or by boat were an almost daily part of the instruction. Students were taken to various areas in the vicinity of the Great Sound. Included are Gull Island, Patty's Hole, Townsends Inlet, Sturgeon's Hole and Stone Harbor Point. The clam flats, spat stations and salt marsh (see map in appendix) were also visited on a regular basis. These formal and informal field trips formed an important part of the instruction. They provided actual work station experience and demonstrated the differences between polluted and unpolluted areas.

In addition to activities originally proposed, the project personnel and students participated in the Cape May Clam Relay program. The program's goal was the transfer of clams from polluted waters to non-polluted waters. After paying the initial fee to the State of New Jersey, Department of Environmental Protection Bureau of Shell Fisheries and the Shell Fisheries Council, we were allocated Lot C102 Section A of the land under the tidal waters of the Great sound. The area was marked and seed clams

transported to the area. The Clam Relay Program itself, however, was discontinued because of lack of participation by commercial clammers in the county. The clams that were moved have been harvested, and sold in the school's fish market.

Students participated in a number of direct experience activities. They attended presentations by speakers in the shell fish industry and utilized current print and non-print media. The media, which addressed the development, expansion and protection of the shell fish industries were organized into a bibliography which appears in the appendix of this report.

Students also monitored the growth of the shell fish, specifically oyster spat which were transported from Pierce's Point on Delaware Bay. A sample of student records was presented in Table 4A & 4B. A devastating storm in late October caused extensive equipment damage, and problems with ice were experienced in January and February.

The transfer of spat and monitoring will continue in the second year of the project.

The forth objective of the project was "To assist project graduates employed in Cape May County in contributing to the future economic development of a unique and fundamental industry."

As previously indicated, there is great difficulty conducting follow-up studies on students who are only in the work force for 6 weeks. There were 10 graduates from the Shell fishing Occupations program in the 1980-81 school year. Two of the graduates were going on for further education. One of the graduates has family responsibilities and is not available for employment. Of the remaining 7 graduates, two are employed in a non-related field, and five are employed in the field. A telephone survey was conducted

of the summer employment of the 23 students who participated in the first year of the project and who are scheduled to return for at least one more year. Of these students 13% were not working, 17% were working part-time either as lifeguards or in the construction field; 26% were working in non-related fields including life guards, and 30% were employed in the field or related fields. This 30% included employment in a fish market, on the docks, on a lobster boat, on a party boat and in clamming. Students who went into commercial clamming did so as a direct result of their experiences with the aquaculture program.

Career information and speaker presentations were discussed under objective 3. The bibliography in the appendix includes examples of career information provided through the career resource center.

3. INTERPRETATION OF FINDINGS

1. Instructors and advisory council have successfully identified a number of job-entry skills in shell fisheries occupations. This was a major goal of the project.
2. Instructors have developed a vocational student profile for shell fisheries occupations. The proficiencies of graduating students were generally higher than those of students in the 10th and 11th grade who participated for the same amount of time.
3. A performance test, both demonstration and written, was developed to be used as a pre and post-test. When administered, this test indicated a lack of student performance in at least ten of thirty-two demonstration areas.
4. The bibliography/list of media that was developed provided an important supplement to classroom, lab, and outside field work. Formal and informal field trips further enhanced the instructional activities.
5. Although fifty percent of the graduates were employed in the field or in related fields at the time of the final report, six weeks in the work force is an insufficient amount of time to make meaningful interpretations of successful job placement.
6. The projects success is indicated by increasing enrollment. The enrollment in the 1980-81 school year was 33 students, an increase of 14 students or 73% over the 19 students enrolled in 1979-80. At the time of the final report, all 23 underclassmen were scheduled to return. In addition, 15 new students have enrolled for the 1981-1982 school year. This indicates an increase of 29 students or 153% over the year preceding this project.

4. DISSEMINATION ACTIVITIES PLANNED AND/OR IMPLEMENTED

The results of the proposed project will be submitted to the Division of Vocational Education and Career Preparation in Trenton for dissemination to interested vocational schools and associations through established state and federal vocational education information networks. In addition, this report will be shared with the Governor's Aquaculture Task Force by Dr. William Wenzel, Assistant Commissioner of Education, Division of Vocational Education and Career Preparation who is also a delegate to that body. Copies of the project results will also be placed in the vocational district's media center and career information center, and will be submitted to the County Library for its collection of educational reference materials.

5. STRATEGIES FOR ELIMINATION OF SEX BIAS AND SEX ROLE STEREOTYPING

To eliminate sex bias and sex role stereotyping the following techniques will be utilized:

1. All project students, staff, and supporting counselors will be oriented to the jobs and employment opportunities for both males and females.
2. In all presentations, speakers, experts, or specialists will be requested to use non-sexist language in both live presentations and written deliveries.
3. Written reports will be reviewed to eliminate sexist language.
4. Members of the district Affirmative Action Committee will review print and non-print materials to assure the absence of sexist language or visuals.

C. SUMMARY

1. Conclusions

The first year of the project has had a good initial impact. Student enrollments have increased, special needs students have been included and a great deal of interest for the second year of the project has been generated. Initial funding has provided supplies, equipment, and staff expertise, but more than one year is necessary for the development of a successful program. Students in the program have been able to practice aquaculture skills including seeding shellfish beds, recording growth and harvesting, and retailing the final product. Performance testing has been developed but there was no opportunity to gather pre-test and post-test data. Continuation of the project would provide that data.

The project has resulted in a working bibliography of books, pamphlets, films, filmstrips and transparencies. These print and non-print media would continue to supplement the classroom, lab and field work if the project were continued.

Involvement in the project has provided a variety of vocational experiences to help students choose satisfying careers. Initial placement figures have been included in this final report. It is difficult, however, to make final conclusions based on students who have been in the job market for only one and a half months. Continuation of the project would also provide more complete and accurate follow-up information.

In addition, this project will continue to balance regular Marine Environmental instruction with more in-depth study of shell fisheries industry. It would provide "career awareness and vocational education" and "job entry-level skills" training as mandated by the T&E process.

2. Recommendations

It is recommended that the project be continued for a second year to provide more complete data in the areas of performance testing and job placement.

In addition, the second year of the project would allow instruction in areas identified as important for job-entry skills in shell fish occupations but not adequately addressed the first year of the project.

Finally a second year of the project would allow for the initiation of a master course of study for the shell fisheries industry.

APPENDIX

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II. PAMPHLETS IN MEDIA CENTER FILE

TITLES:

- Net Mending and Patching
- The Rugged, Independent
- Lobsterman of Maine
- Fisheries as a Profession
- Marine Career Series. Marine related occupations, a primer for High School students.
- Vocational Biography - Clam Caller
- Fishes, Commercial
- Fishers
- Marine Careers

III. FILMS

A. Free Films

EBEC

Air Around Us - 11 minutes
Aging of Lakes - 14 minutes
A Balanced Aquarium - 11 minutes
Beach and Sea Animals - 11 minutes
Boats and Ships - 11 minutes
Fish That Nearly Drowned - 10 minutes
Grasslands - 17 minutes
How Level is Sea Level - 12 minutes
Plankton and The Open Sea - 19 minutes

BFA

Fish - A First Inquiry - 10 minutes
Fish are Interesting - 11 minutes
Life in The Ocean - 16 minutes
Oceanography - Science of The Sea - 10 minutes
Sea Shell Animals - 10 minutes

CORF

Air All About Us - 10 minutes

MGHT

Great Swamp - A Last Wilderness - 25 minutes

ENVRTF

New Jersey Shoreline - 18 minutes

HARPER

Salt Marshes - Border Between Land and Sea - 15 minutes

WAVE

Boundless Sea - 50 minutes

GATEF

Let's Take a Walk By The Seashore - 10 minutes

MOYER

Marine Animals Of The Open Coast - 22 minutes

WILCOX

Marshland Is Not Wasteland - 14 minutes

SCRESC

The Marsh - 12 minutes

NAT GEO

Plankton - 12 minutes

BARR

Seashore - The Atlantic Coast - 15 minutes

NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION
United States Department of Commerce
Motion Picture Service
12231 Wilkins Avenue
Rockville, Maryland 20852

TAKE TWO FROM THE SEA - 28 MINUTES
CATCHING, FILLETING, PACKAGING - 11 MINUTES
FLORIDA, SEAFARE - 27 MINUTES
FRESH OUT OF THE WATER - 14 MINUTES
BASIC NET MENDING - 16 MINUTES
SHRIMP, PLEASE - 21 MINUTES
RETAILING FISH - 18 MINUTES
CLAM AND OYSTER SAM - 14 MINUTES
SHRIMP TIPS FROM NEW ORLEANS - 14 MINUTES
GREAT AMERICAN FISH STORY - 28 MINUTES
GREAT AMERICAN FISH STORY - WEST - 28 MINUTES
GREAT AMERICAN FISH STORY - NORTHEAST - 28 MINUTES
GREAT AMERICAN FISH STORY - SOUTH - 28 MINUTES
GREAT AMERICAN FISH STORY - LAKES & RIVER - 28 MINUTES
HOW TO FILLET FISH - 11 MINUTES
OUTBOARD FISHERMAN U.S.A. - 27 MINUTES
WATERMEN OF CHESAPEAKE - 28 MINUTES

AMERICAN RED CROSS
General Supply Office
American National Red Cross
18th and E Streets, N.W.
Washington, DC 20006

BOATING SAFETY AND RESCUE - 10 MINUTES
SNORKELING SKILLS AND RESCUE TECHNIQUES - 13 MINUTES

TELEFILM LTD.
P.O. Box 709
Homosassa Springs, Florida 32647

SAFE BOATING IS FUN - 27 MINUTES

NORTHWEST PULP AND PAPER ASSOCIATION
Rarig Film Service, Inc.
834 Industry Drive
Seattle, Washington 98188

OYSTER DEVELOPMENT & SURVIVAL - 26 MINUTES

EASTMAN KODAK COMPANY
Audio-Visual Library Distribution
343 State Street
Rochester, NY 14650

DISCOVERING UNDERWATER PHOTOGRAPHY - 27½ MINUTES

DEPARTMENT OF THE NAVY
Naval Education and Training Support Center
Commanding Officer
Atlantic Naval Station
Building 2-86
Norfolk, Virginia 23511

CAREERS IN OCEANOGRAPHY - 24 MINUTES
DIVING FOR SCIENCE - 28 MINUTES
PLANKTON - FIFE OF THE SEA - 25 MINUTES

MODERN TALKING PICTURE SERVICE
2323 New Hyde Park Road
New York, NY 11040

HARVEST OF THE SEA - 26 MINUTES
CHEMICALS - A FACT OF LIFE - 27 MINUTES

MARINELAND OF FLORIDA
Film Librarian
Route 1, Box 122
St. Augustine, Florida 32084

MARINE LIFE PREVIEW - 15 MINUTES

SHELL FILM LIBRARY
1433 Sadlier Cir. W. Dr.
Indianapolis, Indiana 46239

RIVER MUST LIVE - 21 MINUTES
UNDERSEA OASIS - 29 MINUTES

B. RENTAL FILMS

Learning Resource Guide - University of Texas:

Aquatic Locomotion	13.50
Beach & Sea Animals	9.00
Beach & Tide Pool Life	11.25
Fish Are Interesting	9.00
Fishes, Amphibians, Reptiles	11.50
Crustaceans	13.00
Earth Beneath the Sea	11.25
Marine Ecology	11.50
Mission: Oceanography	9.00
Nature's Plan	9.00
Salt Marshes: Border Between Sea & Land	15.00

IV. FILMSTRIPS

Careers in Environmental Protection. California Polytechnic State University. 1976.

National Geographic Society, Sea Life. National Geographic Society. 1973.

Gould Center Filmstrips & Cassettes

- #116 Biochemist
- #118 Biologist
- #059 Boat Builder
- #123 Fish and Game Warden
- #124 Fishers
- #127 Oceanographers
- #191 Out-board Motor Mechanic
- #115 Seaman-able

V. TRANSPARENCIES

Oceanographic Instruments - 3M

- Contents:
- Oceanographic Instruments
 - Floating Instrument Platforms
 - Ocean Depths
 - Research Submersibles
 - Bathyscopes
 - A Deep-sea Winch
 - Drift Bottles
 - Drogues
 - Swallow Floats
 - Nansen Bottles
 - Bathythermographs
 - Dredges
 - Coring Devices
 - Underwater cameras
 - Seismic Refractions
 - Plankton nets
 - Catching large animals
 - Tagging fish

